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(54) Apparatus for collecting and stitching printed sheet elements

(57) Feeder stations (7,8) supply printed sheet elements to each of two or more parallel collecting sections extending transversely to the feed direction, each collecting section having saddle-shaped rest means (3) for the elements received thereby and with entrainment elements (6) movable along the rest means (3) to transport the printed sheet elements towards stitching means (9). During each cycle of the apparatus, the feeder stations (7,8) each feed a collecting section with a printed sheet element.

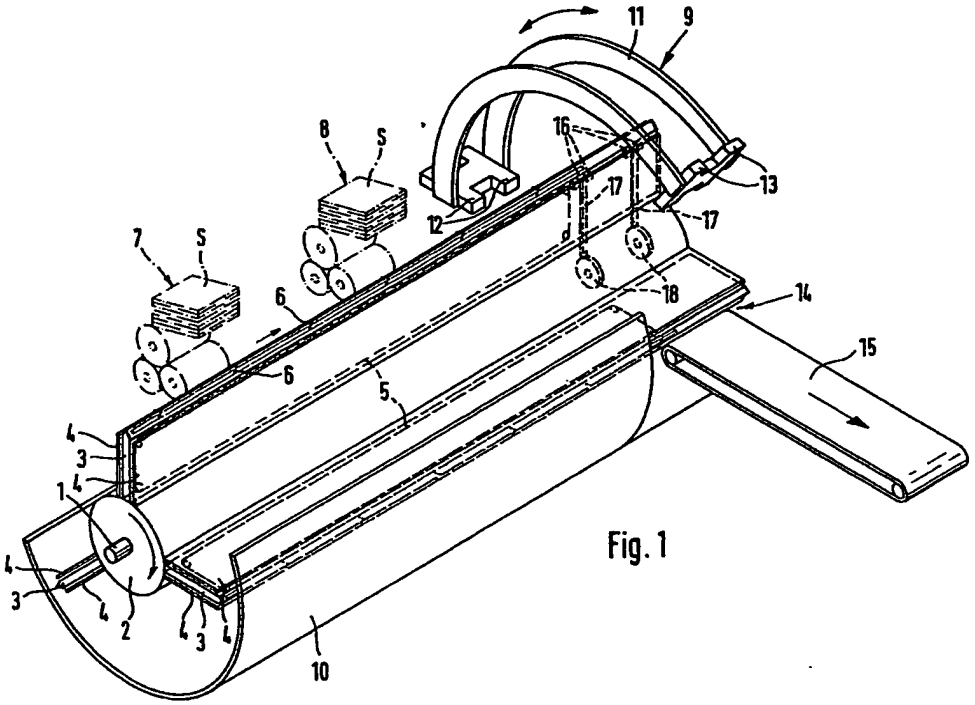

Fig. 1

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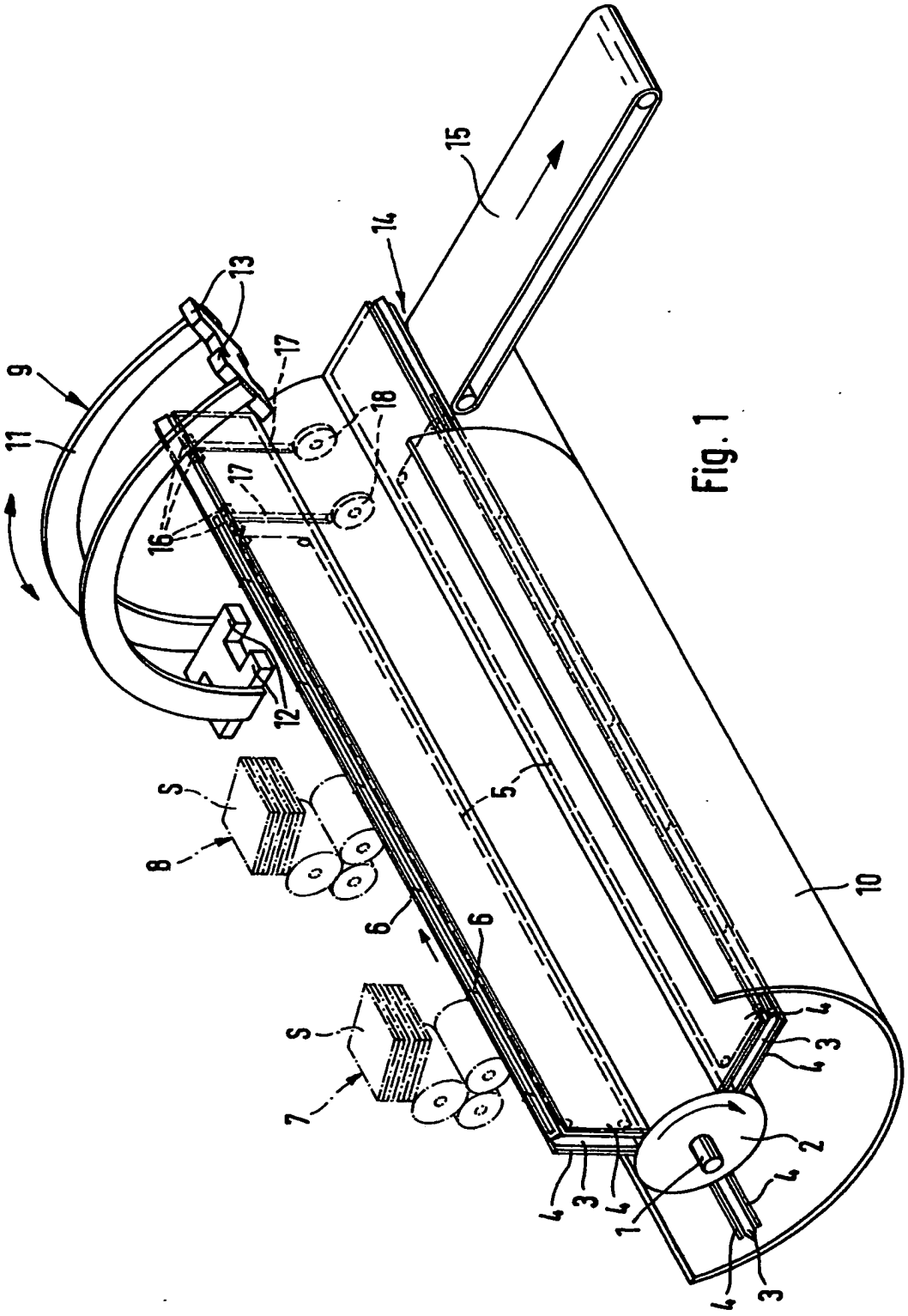


Fig. 1

Fig. 2

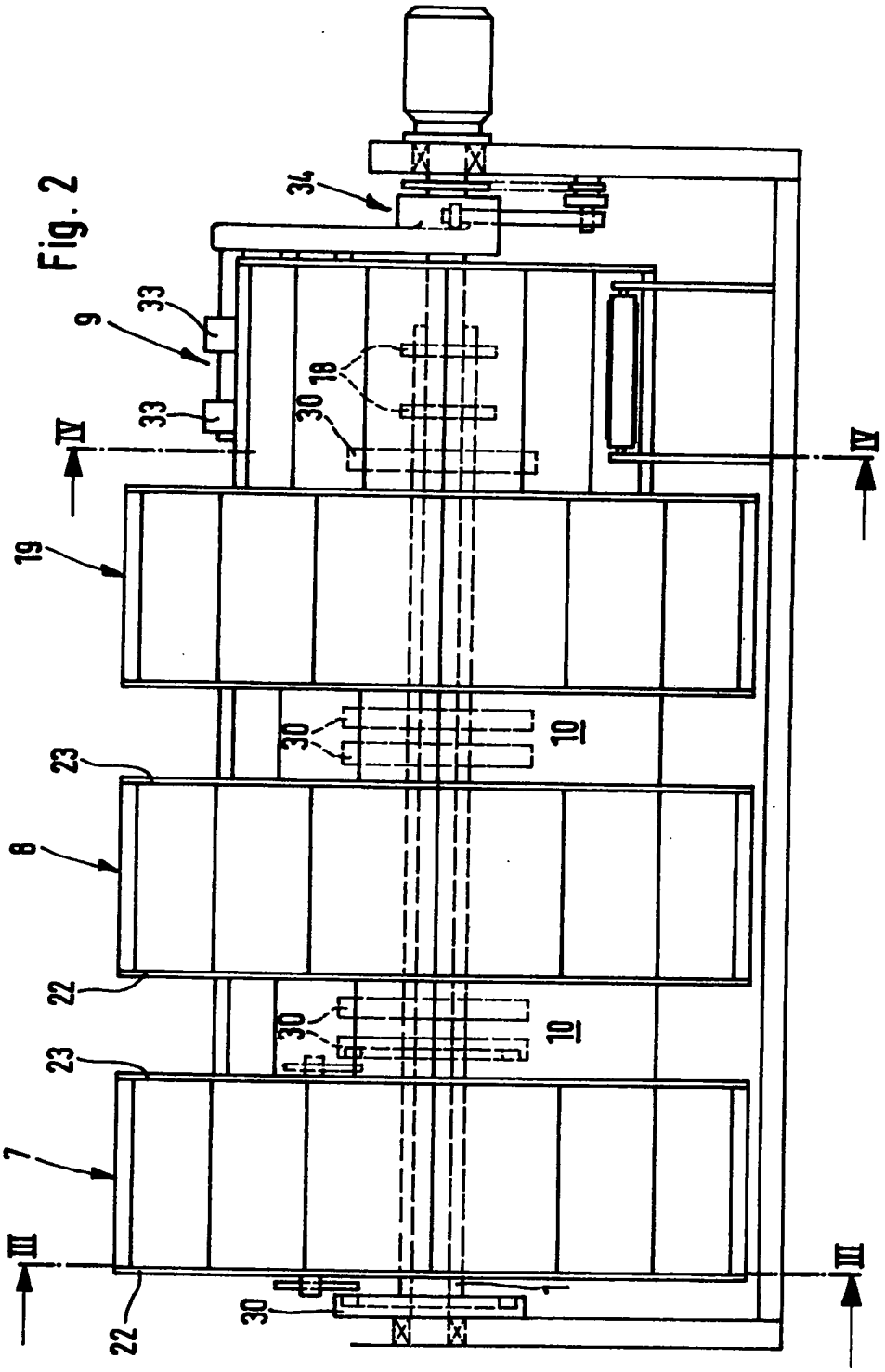


Fig. 3

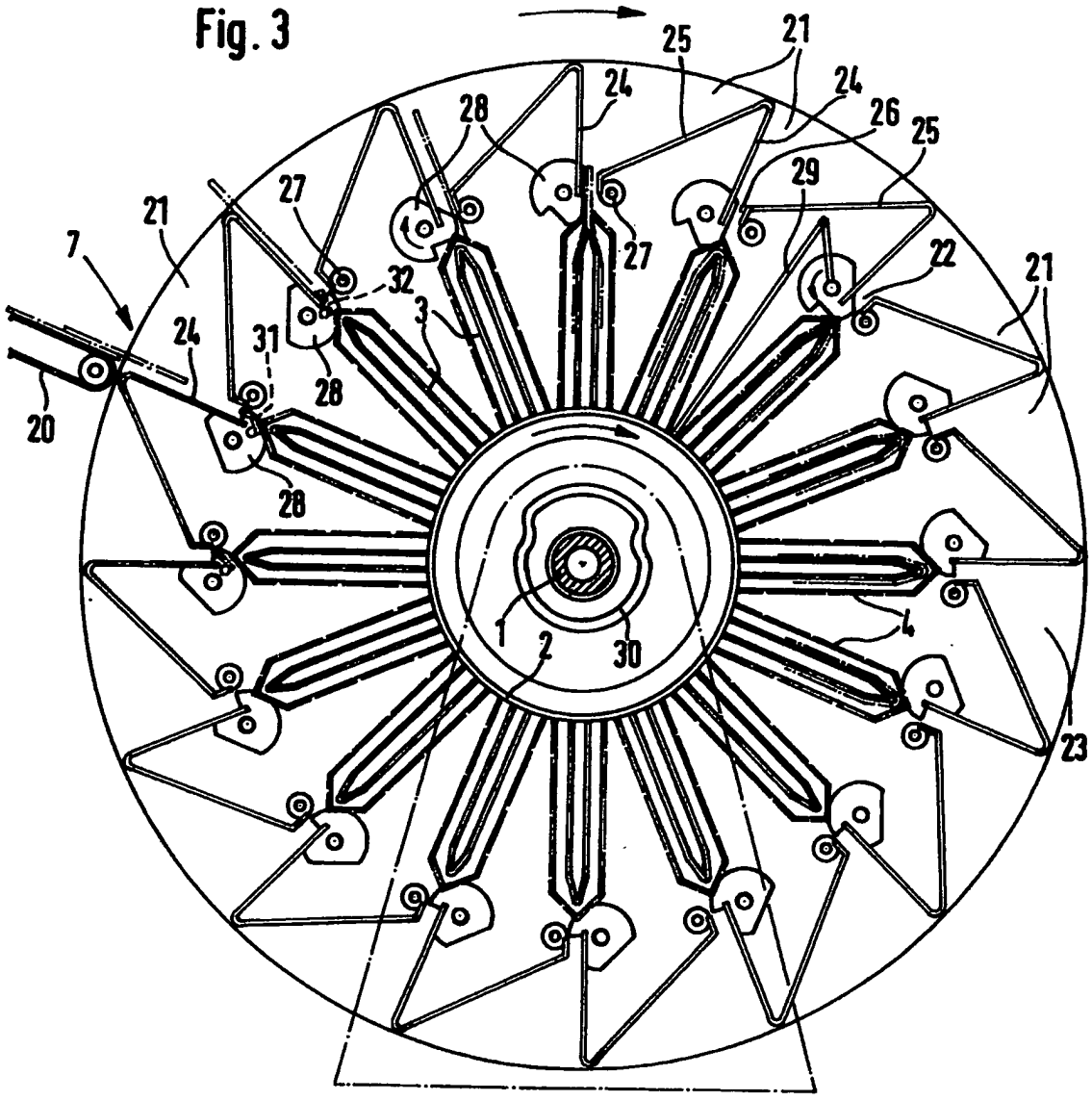
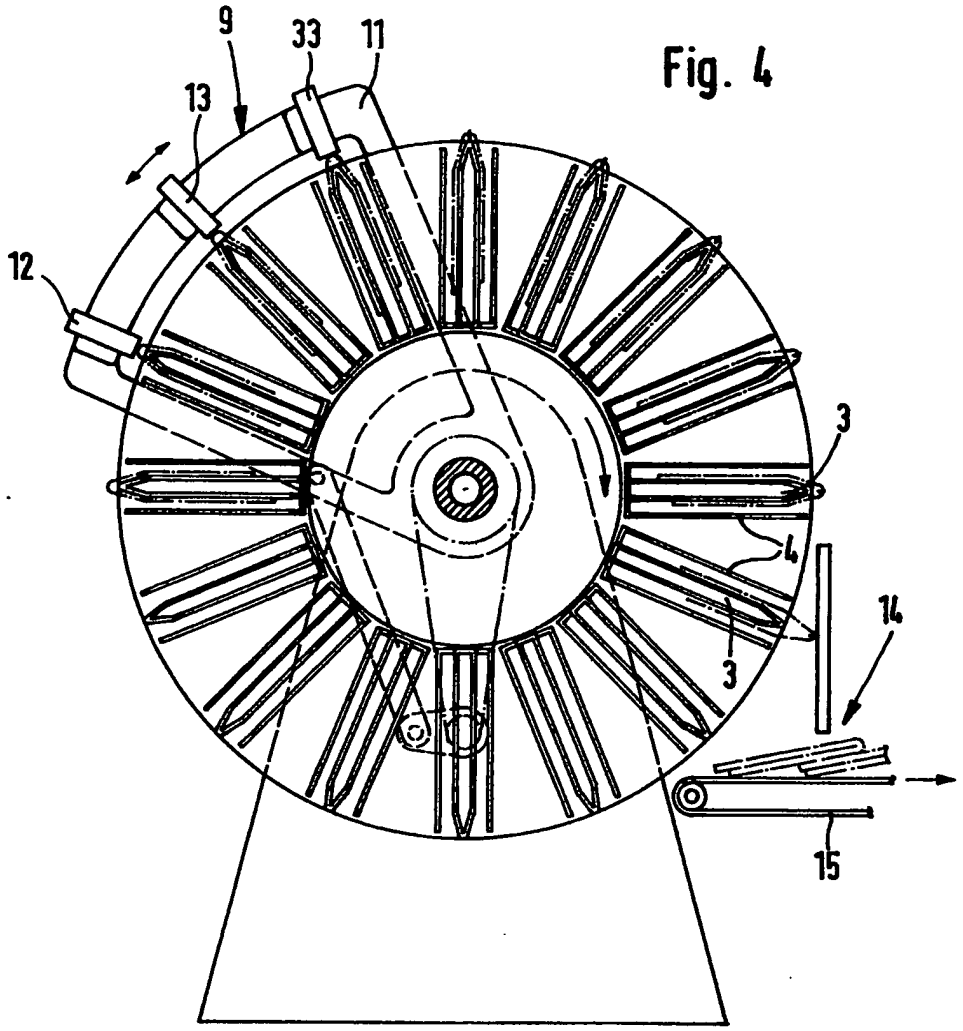


Fig. 4



SPECIFICATION

Apparatus for collecting and stitching printed sheet elements

The present invention relates to apparatus for collecting and stitching printed sheet elements.

Known apparatus of this type includes feeder stations driven at the machine cycle rhythm arranged along a collecting section provided with saddle-shaped rest means on which the printed sheet elements to be stitched are laid. The collecting section is provided with entrainment elements operating along the rest means towards a stitching machine.

More particularly, in such apparatus, the sheet elements are conveyed singly by means of a gripper drum with the fold of the sheet foremost up against an abutment, gripped by opening drums at the open side, accelerated, opened up, and thrown onto a saddle-shaped conveying chain or slide rail. The saddle-shaped conveying chain conveys the sheet elements transversely to the depositing direction past the subsequent feeder stations to a stitching station, and then to a delivery station which transfers the stitched products, transverseley to the direction of conveyance of the conveying chain, to conveyor belts.

Such apparatus is limited in its production speed in that the sheet elements have to be transported entirely singly through the machine, which leads to high conveying speeds. Moreover, only a fraction of a machine cycle is available for the processing of the sheet elements, such as opening, stitching and ejection. The multiple sudden changes of direction also limit the speed of production.

The most modern installations of this conventional type at the present day achieve a production speed of 5 copies per second, and, with such a rate, the physical limits to further increases in output have probably been reached.

To obviate this disadvantage it is known from, for example, German specification no. 2631 058 to impose fewer changes of direction on the products.

The disadvantages that, on the one hand, the products have to be arranged entirely singly and are thus given a high speed of conveyance, and that, on the other hand, only a fraction of a machine cycle is available especially for the stitching operation, cannot be obviated with this apparatus.

With this machine, also, the products are opened out simply by the action of centrifugal and gravitational forces, and this cannot be achieved reliably when dealing with products which have acquired a static charge or are slightly sticky from the printing ink.

These remaining drawbacks do not allow a substantially higher production speed.

In a similar way to the arrangement disclosed in German specification no. 26 31 058, the products in the case of the apparatus according to European specification no. 95 603 are taken past the feed conveyors with the fold situated transversely to the direction of conveyance. A difference is that the reception saddles, which are arranged in the manner of ladder rungs, are positioned relatively near to one another, and the two wings of the printed sheet elements hang down freely. It is difficult to imagine, and it is left open in the patent specification, how the freely depending wings of the printed sheet elements are to be held in a stable position and how the stitching operation is to be carried out on the gathered products. If such products are to be stichable, it is necessary to have precisely guided holding-up elements (benders) which co-operate with the stitching heads and bend-round the pushed-through ends of the stitching wire pieces. It is hard to imagine such holding-up elements being brought in between the wings of the printed sheet elements in the stitching region, since the wings are laid back and flutter due to the wind caused by travel. It is also difficult to imagine that each reception saddle can be constructed as a holding-up element, guided with the appropriate precision, and also given the mechanical means for bending-round the wire piece ends, quite apart from the massive outlay which would result.

An apparatus not in the category specified (Swiss specification no. 584153) is used for inserting at least one pre-product into a folded main product of a printing works. The products are introduced with their fold foremost into the individual compartments of a rotating compartmented wheel, displaced along the wheel axis to the next infeed point in the course of one revolution of the compartmented wheel, and at the same time opened.

Means for opening the products are provided only between the first and second infeed points, and also the means proposed are not suitable for the precise central opening of sheet elements which are to be stitched, these usually consisting of a plurality of individual sheets folded inside one another. Moreover the folds of the products situated within the interior of the compartmented wheel are no longer accessible for the stitching operation.

It would be desirable to provide an apparatus for collecting and stitching printed sheet elements which, whilst allowing the products to be dealt with with the same precision as that achieved with the conventional machine, allows the production speed to be significantly increased..

According to the present invention there is provided apparatus for collecting and stitching printed sheet elements comprising a plurality of feeder stations adapted to supply printed sheet elements to each of two or more collecting sections extending parallel with one another, each collecting section including saddle-shaped rest means for the printed sheet elements received thereby and entrainment elements operable along said rest means to transport the printed sheet elements towards stitching means, the arrangement being such that, during each cycle of the apparatus, the feeder stations each successively feed an associated one of the collecting sections with a printed sheet element.

Such apparatus has the distinct advantage that the supplying of consecutive collecting sections by the feeder stations can be carried out with comparatively little constructional outlay.

Preferably the collecting sections are arranged in

an axially symmetrical manner about, to be rotatable with, a shaft, means provided to maintain the printed sheet elements in contact with the associated saddle-shaped rest means throughout rotation of the shaft.

Conveniently a stitiching means is simultaneously associated with at least two adjacent collecting sections and includes at least one stitching head for each associated collecting section, while the stitching heads may be driven in unison with one another.

Such an arrangement has the advantage that more time is available for the carrying out of the stitching operation than heretofore whereby the output of the apparatus can be further increased.

Preferably the region of action of the stitching heads follows the region of action of the entrainment elements, said stitching heads being mounted on the shaft to be pivotal thereabout, allowing the apparatus to be of a compact and therefore space-saving construction.

In one embodiment of the invention, funnel-shaped pockets are provided in the region of the feeder station, said pockets being disposed axially symmetrically about the shaft and being rotatable with the collecting sections, one pocket being associated with each collecting section and having an outlet end directed towards said collecting section, each pocket being provided, at the outlet end thereof, with spreading elements for spreading out a printed sheet element fed into said pocket. Such an arrangement results in substantially more time being available than heretofore for the opening out of the printed sheet elements, thus further improving the output of the apparatus.

The spreading elements may be adapted to be operated by stationary control cams.

Conveniently each collecting section includes, in the region of the associated stitching means, benders which co-operate with the stitching heads and which are operable by stationary cam discs in dependence upon the rotational position of said collecting section.

By way of example only, the invention will now be described in greater detail with reference to the accompanying drawings of which:

Figure 1 is a perspective view of part of a first apparatus according to the invention;

Figure 2 is a view of a second apparatus according to the invention;

Figure 3 is a section on line III-III of Figure 2, and

Figure 4 is a section on line IV-IV of Figure 2.

Referring to Figure 1, a cylinder 2 is mounted on a stationary shaft 1 to be rotatable thereon and to be capable of being driven at the machine rhythm by means (not shown) in such a manner that, during a machine cycle, the cylinder 2 rotates through 120°, and therefore carries out one complete revolution over three machine cycles.

Three collecting sections, each with a saddle-shaped rest 3, are arranged in an axially symmetrical manner along, and are secured to, the cylinder 2. Laterally of each rest 3 are arranged parallel guide plates 4 which prevent a printed sheet element lying on a rest 3 from opening out when the cylinder 2 rotates.

Entrainment elements 6 secured on an endless chain 5 and guided in longitudinal slots are movable along each saddle-shaped rest 3 and cause printed sheet elements deposited on a rest 3 to be displaced along said rest 3.

Situated along the shaft 1 are conventional feeder stations 7 and 8 by which the printed sheet elements to be gathered and stitched are opened out and deposited on the rests 3. Such feeder stations 7, 8 are described in, for example, US patent specification no. 3 199 862. On each cycle of the machine, they take the lowest printed sheet element in each case from the stacks "S", open it out and lay it on one of the rests 3 which, as they rotate about the shaft 1, move successively past the feeder stations 7, 8.

During one complete revolution of the cylinder 2 together with the saddle-shaped rests 3, the entrainment elements 6 are displaced from one feeder station 7 to the next feeder station 8 (although more than two feeder stations may be provided). Said elements 6 thus move along a helical path of travel past the feeder stations 7, 8 to a stitching apparatus 9 situated at the end of the cylinder 2. So that the printed sheet elements remain in contact with the rests 3 whilst the printed sheet elements are moved through below the cylinder 2 - i.e. so that the elements do not fall from the rests 3 - a half-cylindrical casing 10 is provided against which the folds of the printed sheet elements abut during the lower half of their rotary movement.

The stitching apparatus 9 comprises a bowed member 11 mounted on the shaft 1 to be pivotable thereabout. Arranged on the bowed member 11 are two stitching head pairs 12,13 which are offset from one another by 120° about the axis of the shaft 1. Instead of a pair of stitching heads, it is possible to provide only one stitching head, or more than two stitching heads may be provided. The bowed member 11, together with the pairs of stitching heads 12,13, carries out a to and fro pivoting movement and follows the movement of the rests 3 at the same speed.

The path of circulation of the entrainment elements 6 operating along the rests 3 terminates before the stitching apparatus 9, so that the gathered printed sheet elements are stationary relative to the stitching apparatus 9 at the end of a rest 3 and in the region of said stitching apparatus. The elements are thus diverted onto a circular path of travel concentric with the shaft 1.

The co-moving pairs of stitching heads 12,13, during synchronous movement with the rests 3, each carry out a stitching operation at the same time, whereby the mutually super jacent printed sheet elements of two collecting sections are stitched together. Then, at a delivery station 14, where a suitable aperture is provided in the half-cylindrical casing 10, the part-products stitched to form printed products fall onto a conveyor belt 15 and are transported away.

Arranged inside the saddle-shaped rests 3, in the region of the stitching apparatus 9, are benders 16 which co-operate with the stitching heads 12,13 and which are operated through push rods 17 by means of cam discs 18 secured on the shaft 1. The operation

of the stitching heads and of the benders is known and is described in, for example, Swiss patent specification no. 549 443.

It will be appreciated that, in the apparatus so far described, it would be possible to arrange more than three collecting sections in axially symmetrical manner on the cylinder 2 about the shaft 1, a corresponding number of machine cycles then being required for the cylinder 2 to carry out one complete revolution. The greater the number of collecting sections mounted on the cylinder 2, the more slowly may the cylinder 2 rotate and the lower becomes the speed at which the chain 5 circulates.

In the example of Figures 2 to 4, like reference numerals designate like or equivalent parts to those of the example of Figure 1.

Referring to Figures 2 to 4, there are three feeder stations 7,8,19 with sixteen collecting sections each having a saddle-shaped rest 3 arranged on the cylinder 2, said cylinder 2 again being mounted to be rotatable about a stationary shaft 1. The parts corresponding to the entrainment elements 6 and to the chains 5 in the example of Figure 1 are not shown.

The three feeder stations 7,8,19 are each of identical construction, so that only one will be described hereinafter. These stations each comprise a conveyor belt 20 on which the printed sheet elements are introduced singly one after the other or in overlapping stream formation, a preceding printed sheet element always lying on the succeeding element in the second case. The feeder station 7 also comprises a pocket 21 associated with each rest 3, said pockets being connected to and rotating with the cylinder 2 and narrowing in wedge-shaped manner towards the associated rest 3 to form a funnel-shaped outlet aperture 26 towards said rest. The pockets 21 are each formed, on the one hand, by lateral plates 22,23, and, on the other hand, by two plates 24,25 secured on the first-mentioned plates and inclined towards one another, the trailing plate 24 as considered in the direction of rotation (shown by the arrow) extending substantially radially of the cylinder 2.

A freely rotatable roller 27 is mounted at each outlet aperture 26, opposite which roller 27 is situated a pivotally mounted spreader drum 28. As shown in Figure 3, a spreader drum 28 can be pivoted into specific rotational positions by means of an associated push rod 29 and cam disc 30 secured on the shaft 1.

In a first rotational position of the spreader drum 28, which it ocupies opposite the conveyor belt 20, said drum 28 blocks with one shoulder 31 the outlet aperture 26. The pocket 21 travelling past the conveyor belt 20 lifts, with its trailing plate 24, the foremost printed sheet element from the partly overlapping stream, and said element slides into the pocket 21 as further rotation occurs, until its leading edge (i.e. the forefold) abuts against the shoulder 31.

In this position, a gripper 32 is swung against the forefold of the printed sheet element, and the element half provided with the forefold is held fast. The spreader drum 28 is then turned clockwise through 90°, whereby the printed sheet element is drawn downwardly, and the element side with the forefold is spread out laterally.

After a further 45° rotational movement, the other side is pushed over the rest 3 and the forefold is released from the gripper 32, so that the printed sheet element falls under gravity onto the rest 3, The spreader drum 28 is then turned back into its first rotational position, in which the shoulder 31 again blocks the outlet aperture 26 of the pocket 21. it would also be possible to rotate the spreader drum each time through 360°, the necessary means for that purpose being familiar to the person skilled in the art.

After being transferred from the belt 20, the printed sheet element is, during sixteen machine cycles, laid on the rest 3, rotated once through 360° about the shaft 1, and displaced along the rest 3 to the next feeder station 8 to a position below that pocket 21 in which there is situated a printed sheet element deposited by the following belt 20. The drive for the belt 20 is chosen such that, on each cycle of the machine, the next printed sheet element in the over-lapping stream of such elements in each case reaches the end of the belt 20 and is deposited into the next pocket 21 in sequence. Thus, with three feeder stations 7,8,19, three part-products or sub-products can be processed to make a printed product. The number of part-products to be processed, however, can be extended substantially optionally by appropriate addition of further feeder stations, and, of course, the rests 3 will be lengthened correspondingly.

By means of the entrainment elements (not shown), the printed sheet elements are transported into the region of the stitching aparatus 9 at the end of the rests 3, where they are moved through below the stitching heads on a circular path of travel concentric with the shaft 1. The stitching apparatus 9 again comprises a bowed member 11 pivotally mounted about the shaft 1 to undergo a to and fro movement achieved by means of a pivoting-movement drive 34. Three stitching apparatus 12,13 and 33 are arranged on the bowed member 11 offset from each other by 22.5° about the shaft 1, said apparatus moving synchronously with the cylinder 2 to stitch simultaneously three gathered printed products. On further rotation of the cylinder 2, the stitched printed products pass to the delivery station 14 and slide onto the conveyor belt 15 to be carried away thereby.

CLAIMS

1. Apparatus for collecting and stitching printed sheet elements comprising a plurality of feeder stations adapted to supply printed sheet elements to each of two or more collecting sections extending parallel with one another, each collecting section including saddle-shaped rest means for the printed sheet elements received thereby and entrainment elements operable along said rest means to transport the printed sheet elements towards stitching means, the arrangement being such that, during each cycle of the apparatus, the feeder stations each successively feed an associated one of the collecting

sections with a printed sheet element.

2. Apparatus as claimed in claim 1 in which the collecting sections are arranged in an axially symmetrical manner about, to be rotatable with, a shaft, means being provided to maintain the printed sheet elements in contact with the associated saddle-shaped rest means throughout rotation of the shaft.

3. Apparatus as claimed in claim 2 in which a stitching means is simultaneously associated with at least two adjacent collecting sections and includes at least one stitching head for each associated collecting section.

4. Apparatus as claimed in claim 3 in which the stitching heads are driven in unison with one another.

5. Apparatus as claimed in claim 3 or claim 4 in which the region of action of the stitching heads follows the region of action of the entrainment elements, said stitching heads being mounted on the shaft to be pivotal thereabout.

6. Apparatus as claimed in any one of claims 2 to 5 in which funnel-shaped pockets are provided in the region of the feeder stations, said pockets being disposed axially symmetrically about the shaft and being rotatable with the collecting sections, one pocket being associated with each collecting section and having an outlet end directed towards said collecting section, each pocket being provided, at the outlet end thereof, with spreading elements for spreading out a printed sheet element fed into said pocket.

7. Apparatus as claimed in claim 6 in which the spreading elements are adapted to be operated by stationary control cams.

8. Apparatus as claimed in claim 3 and claims dependent therefrom in which each collecting section includes, in the region of the associated stitching means, benders which co-operate with the stitching heads and which are operable by stationery cam discs in dependence upon the rotational position of said collecting section.

9. Apparatus for collecting and stitching printed sheet elements substantially as described with reference to and as illustrated by Figure 1 or Figures 2 to 4.

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